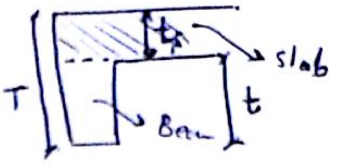
2- Design of B_1 : (Panelled Beam)

$b = 250\ mm$

$T = 500\ mm$ [Given]

* $o.w = \gamma_c \cdot b \cdot t * 1 = 25(0.25)(0.5-0.15)*1 = 2.187\ KN/m'$

$t \rightarrow (T - t_s)$



* $\Sigma o.w = [(\overset{n_1}{2} * \overset{L_1}{15}) + (\overset{n_2}{2} * \overset{L_2}{18})] * \overset{o.w}{2.187} = 144.375\ KN$

* $W_{eq.} = W_{us} + 1.4 \frac{\Sigma o.w}{Area - Voids} = 13.125 + \frac{1.4 * 144.375}{15 * 18 - (2*5*6)} = 14.1\ KN/m^2$

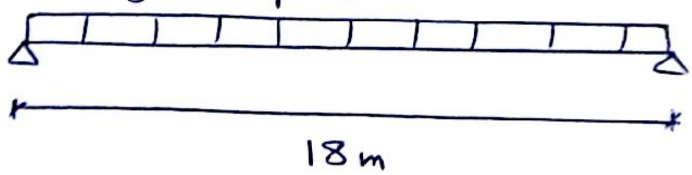
1.4 → ultimate factor

بإسقاطه في C.L في الاتجاه العمودي

الاتجاه من الطويل

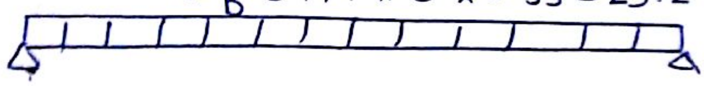
$W_B = W_{eq}\ (\phi : \phi) * \beta$

$\alpha = \frac{L_L^4}{L_L^4 + L_s^4} = 0.67$



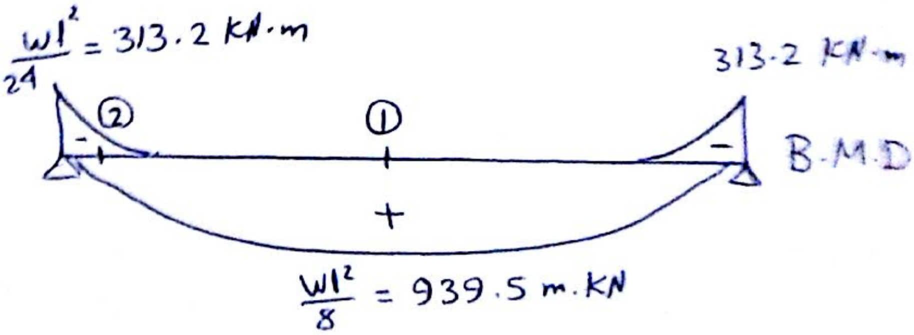
$\beta = \frac{L_s^4}{L_L^4 + L_s^4} = \frac{6^4}{6^4 + 5^4} = 0.33$

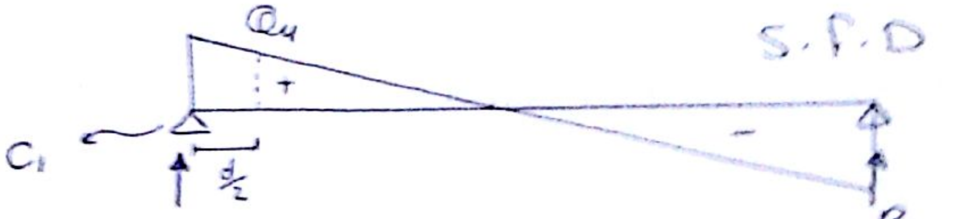
$W_B = 14.1 * 5 * 0.33 = 23.2\ KN/m'$



يفضل حسابها للبلاطة ككل

$\beta = \frac{15^4}{18^4 + 15^4} = 0.33$





$R_1 = \frac{wl}{2} = \frac{23.2 * 18}{2}$

$= 208.8$ KN

$R_1 = 208.8$ KN

<u>For Sec 1-1</u>

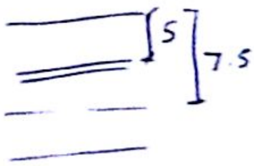
$M_u = \frac{wl^2}{8} * R.F$

$R.F = \frac{\sin\theta}{\sin 90}$

$\theta = \frac{5}{7.5} * 90 = 60^\circ$

بعد الكمرة عن الطرف

بحر البلاطة



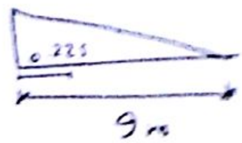
$\therefore R.F = \frac{\sin 60}{\sin 90} = 0.866$

<u>For max. Shear:</u>

$d = T - \text{Cover} = 500 - 50 = 450$ mm

Cover ≤ 50 mm

$\frac{d}{2} = 0.225$ m



$\frac{(9 - 0.225)}{9} = \frac{Q_u}{208.8}$

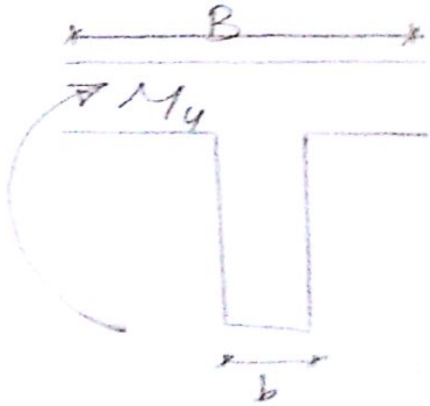
$\therefore Q_u = 202.884$ Kn $* R.F$

$M_u = 939.5 * 0.866 = 813.6$ KN.m

$Q_u = 202.884 * 0.866 = 175.7$ KN

<u>For Sec 1-1</u>

$R = \frac{M_u}{B d^2} = \frac{813.6 * 10^6}{2650 * (450)^2} = 1.5$



$\mu = 0.54$

$A_s = \frac{\mu}{100} B \cdot d = \frac{0.54}{100} * 2650 * 450$

$B = 16 t_s + b$

$= 16 * 150 + 250 = 2650$ mm

$A_s = 6439.5$ mm^2 $\Rightarrow$ Use 14 ϕ 25 $\Rightarrow A'_s = 0.2 A_s \rightarrow$ use 3 ϕ 25

$$q_u = \frac{Q_u}{b \cdot d} = \frac{175.7 * 10^3}{250 * 450} = 1.56 \text{ MPa } (N/mm^2)$$

$$q_{cu} = 0.24\sqrt{\frac{f_{cu}}{\gamma_c}} = 0.24\sqrt{\frac{25}{1.5}} = 0.98 \text{ MPa}$$

Factor

$q_u > q_{cu}$ unsafe $\rightarrow \therefore q_{str} = q_u - \frac{q_{cu}}{2} = 1.07$ MPa

$$\therefore S = \frac{n A_{str} \frac{f_y}{\gamma_s}}{q_{str} * b} = \frac{n A_{str} * \frac{0}{1.15}}{1.07 * 250}$$

$\therefore S = 1.17 \cdot n A_{str}$

عدد فروع الكانة

نوع (مساحة قطر السيخ)

$n = 2$

$A_{str} = \frac{\pi (8)^2}{4} = 50.26 \text{ mm}^2$

For $\phi 8 \rightarrow f_y = 240$ MPa

& For $\# 10 = 78.5 \text{ mm}^2 \rightarrow f_y = 360$ MPa

$\therefore S = 1.17 * 2 * 8 = 183.7$ mm $\Rightarrow n = \frac{1000}{S}$

Use $6 \# 10 / m'$ take $S = 167$ mm

<u>Sec 2-2</u>

$M_u = 313.2$ KN.m

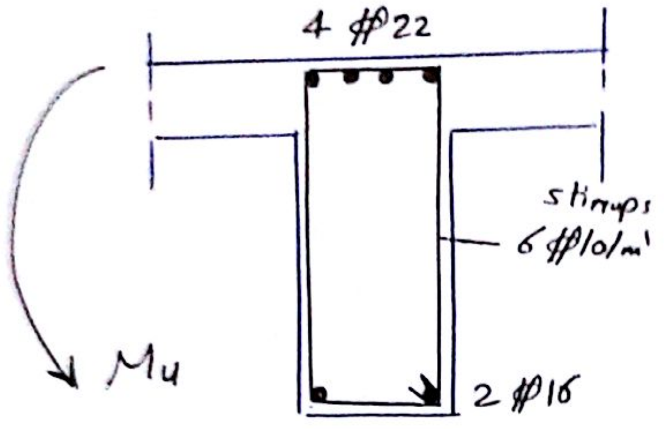
$$R = \frac{M_u}{b \cdot d^2} = \frac{313.2 * 10^6}{250 * (450)^2} = 6$$

$\mu = 1.25$

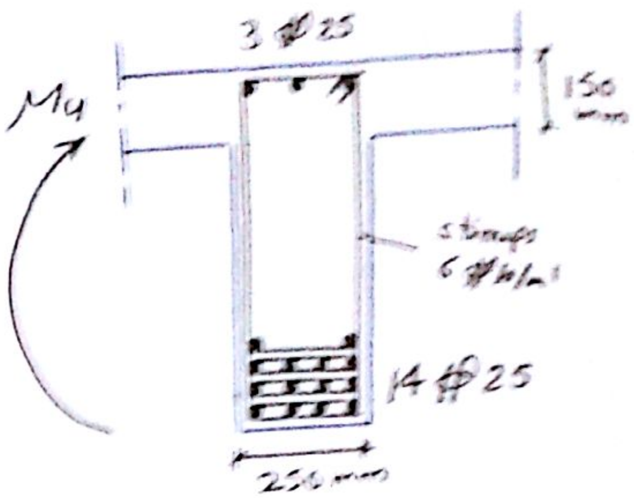
$$A_s = \frac{\mu}{100} * b d = \frac{1.25}{100} * 250 * 450 = 1406.25 \text{ mm}^2$$

Use $= 4 \# 22$

$A_s' = 0.2 A_s = 281.25$; use $2 \# 16$



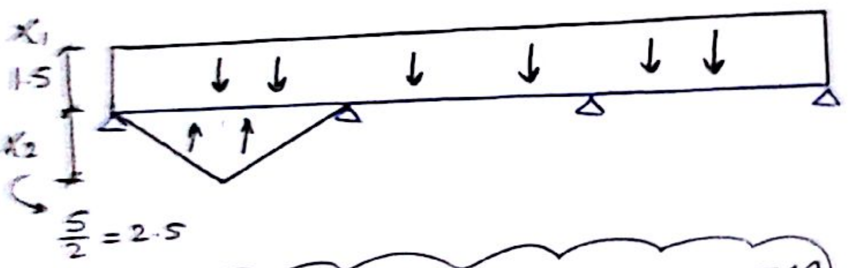
Sec 2-2

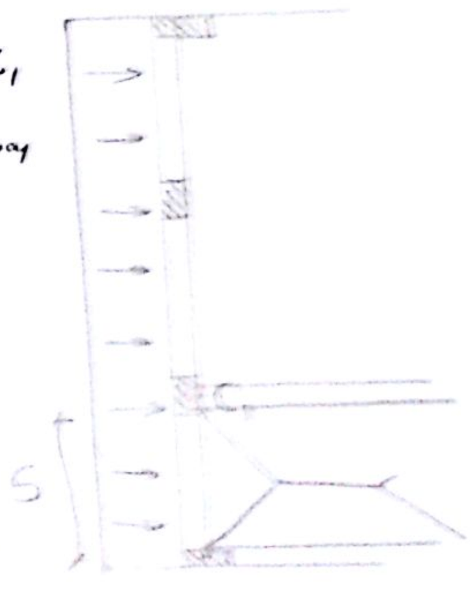


Sec 1-1

Design of B_2 : كمرة داخلية

$$W_{Bu} = 1.4\ O.W + \underset{\substack{\text{or}\\ \alpha}}{W_{us}\ \beta}\ X_2 + \underset{\text{one way}}{W_{us} * X_1}$$

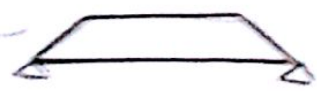




$r = 1.2 \longrightarrow$ From Chart $\Rightarrow$ $\alpha = 0.769$, $\beta = 0.582$

$\Rightarrow O.W = \gamma_c \cdot (T - t_s) * b * 1$

$\therefore O.W = 25(0.7 - 0.15) * 0.25 * 1 = 3.44\ kN/m'$



$\therefore$ Load For Moment $\Rightarrow W_\alpha = W_m$

$W_m = 1.4 * 3.44 + 13.125 \overset{\alpha}{*} \frac{2}{3} * 2.5$

$+ 13.125 * 1.5$

$W_m = 46.4\ kN/m'$

$\alpha = \frac{2}{3}$

$\beta = \frac{1}{2}$

لو شكل مختلف :

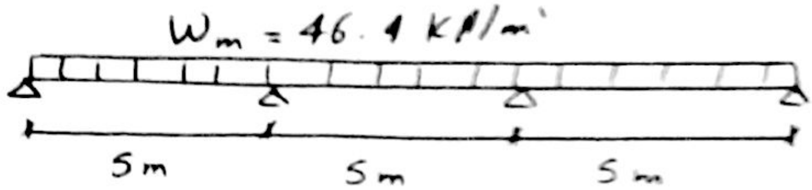
$W = W_{su} * \frac{\sum Area}{span}$

Load for shear & Reactions:

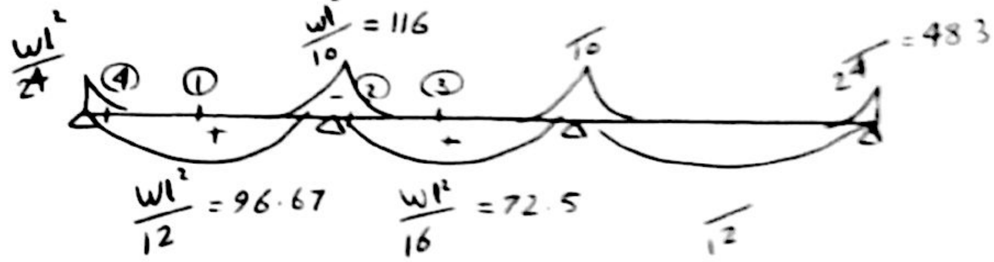
$$W_s = 1.4 * 3.44 + 13.125 * \frac{1}{2} * 2.5 + 13.125 * 1.5$$

$$\therefore W_s = 40.9 \ KN/m'$$

Design for flexure:



قيم الكمرات من Chart



Sec 1-1

$$M_u = 96.67 \ KN.m$$

$$R = \frac{M_u}{B d^2} = \frac{96.67 * 10^6}{2650 * (650)^2} = 0.086$$

T - cover

50mm

$$\mu = 0.3$$

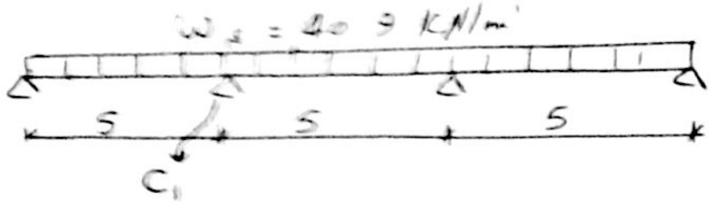
$$A_s = \frac{\mu}{100} b d = \frac{0.3}{100} * 2650 * 650 = 5167.5 \ mm^2$$

Use : 14 ϕ 22

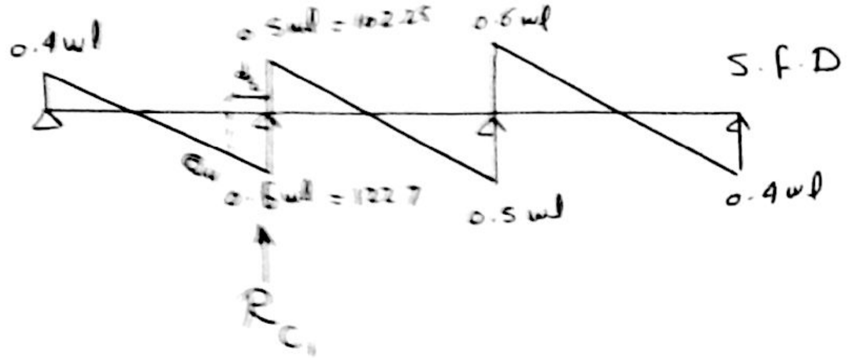
وهكذا مع باقي القطاعات ونرسمهم كما سبق

Design for Shear:

$$q_u = \frac{Q_u}{b \cdot d}$$



From Chart



Take: $Q_u = 122.7$ kn

$$\therefore q_u = \frac{122.7 * 10^3}{250 * 700} = 0.7 \text{ MPa}$$

$$q_{cu} = 0.24\sqrt{\frac{f_{cu}}{\gamma_c}} = 0.24\sqrt{\frac{25}{1.5}} = 0.98 \text{ MPa}$$

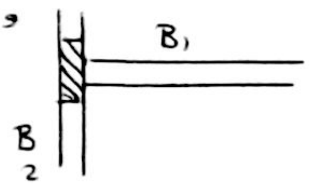
$\therefore q_u < q_{cu} \Rightarrow$ Safe $\Rightarrow$ use min stirrups 5 ϕ 8/m'

$$R_{C_1} = 0.6wl + 0.5wl = 122.7 + 102.25 = 224.95 \text{ KN}$$

[4] Load of C_1

العمود شايل R من الكمرة B_2 و R من الكمرة الأخرى B_1

وشايل وزنه بالإضافة إلى أنه متكرر ف عدد الأدوار.



$\therefore$ Load of Column $C_1 = R * n * 1.1$

Reactions — عدد الأدوار — تعويضاً عن o.w

$$R = R_{C_1} + R_1 = 224.95 + 208.8 = 433.75 \text{ KN}$$

$$\therefore R = 433.75 \text{ KN}$$

$$\therefore P_u = R * n * 1.1 = 433.75 * 1 * 1.1 = 477.125 \text{ KN}$$

ما لم يذكر خلاف ذلك

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[5] Design of Column C_1 :

$$P_u = 0.35 f_{cu} A_c + 0.67 f_y A_s$$

assume $A_s = 0.01 A_c$

$$\therefore 477.125 * 10^3 = 0.35 * 25 A_c + 0.67 * 360 * 0.01 A_c$$

$$\therefore A_c = 42745.5 \text{ mm}^2$$

assume $b = 300$ mm $\Rightarrow \therefore t = \frac{A_c}{b} \approx 142.5 \text{ mm} < b$

no

$\Rightarrow$ Take $A_c = b * t = 250 * 250 = 62500 \text{ mm}^2$

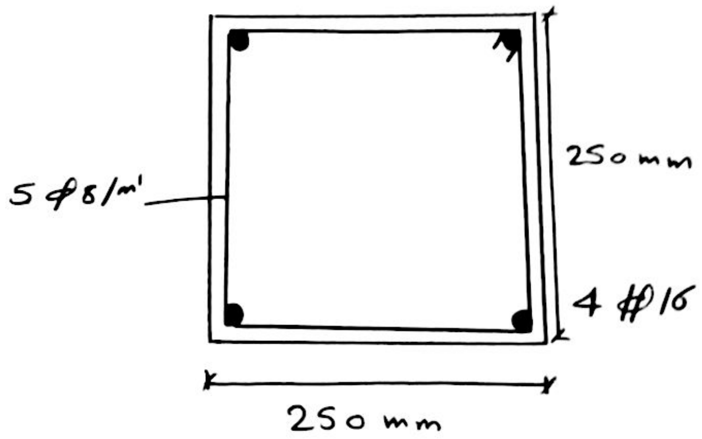
بالتعويض مرة أخرى في المعادلة بـ A_c الحقيقية

$\therefore 477.125 * 10^3 = 0.35 * 25 * 62500 + 0.67 * 360 * A_s$

$\therefore A_s = -ve$

use $A_s = 0.008 A_c = 0.008 * 62500 = 500\ mm^2$

use 4 #16



⇐ في حالة العمود الدائري بعد أن نحصل على A_c

$$A_c = \frac{\pi D^2}{4} \Rightarrow$$

نحصل على
قطر D
العمود

ونكمل عادي ....